

Chapter 9

CEMENT CONCRETE BARRIER

Introduction

There are two types of concrete barriers; one is a concrete median barrier and the other is a temporary concrete barrier. A concrete median barrier is used for safety by separating traffic traveling in opposite directions or traveling in the same direction and by redirecting errant vehicles. Concrete median barrier is a permanent barrier. Temporary concrete barrier may be used as a median barrier as stated above for a temporary situation or may be used to protect traffic from a temporary construction hazard as in bridge repairs.

Concrete barriers are either cast in place or precast. Both types will be discussed in this chapter as well as precast temporary concrete barrier.

Standard Sheet 602-CCMB-01 & 04 contains the dimensional as well as other requirements for concrete median barriers. Standard Sheet 801-TCCB-01 contains the dimensional as well as other requirements for temporary concrete barrier.



Grade Preparation

Grade Preparation for concrete median barrier is the same for cast in place or precast. The excavation is made to the required depth and width for the barrier and compacted to a firm even surface. All soft and unsuitable material must be replaced with acceptable material and thoroughly compacted.

PRECAST CONCRETE MEDIAN BARRIER

Description	<p>Precast concrete median barrier is normally produced in a casting yard or a concrete plant. After casting and after passing your final inspection they are shipped to the job site and set in place.</p> <p>Precast units may be a minimum of ten feet in the length to a maximum of 20 feet. Whatever length is selected, it should not vary throughout the project except at special situations such as inlets or bridge abutments. Many special situations will require that a small section of barrier be cast in place.</p> <p>Standard Sheet 602-CCMB-01 & 04 should be consulted for the proper cross-sectional dimensions. The current dimensions for concrete median barrier are shown there for your convenience.</p>
Forms	<p>The forms used for precast concrete median barrier are generally made of steel and must be unyielding, mortar tight, and of sufficient rigidity to prevent distortion. It must be so designed that the finished product will conform to the required dimensions and contours. All sharp corners must be chamfered.</p> <p>Prior to placing the concrete, the interior of the forms must be coated with paraffin oil or other approved coating. Do not allow the use of lubricating oils, fuel oils, or kerosene as these will cause the concrete to discolor. Immediately after the forms are stripped, they must be thoroughly cleaned.</p>
Concrete Composition	<p>The composition of the concrete for precast concrete median barrier is different than the concrete mixes previously discussed.</p> <p>The following is a list of materials used in precast concrete construction:</p> <ul style="list-style-type: none">Portland CementFly Ash (optional)Fine Aggregate, Size No. 23Coarse Aggregate, Class A, Size No. 91Air Entraining AdmixtureWater Reducing / Retarding AdmixturesWater <p>Note that the main difference is the coarse aggregate; which is size no. 91.</p>

**Continuation of
Concrete
Composition**

The actual mix design is the responsibility of the supplier. Our specifications require that the mix is capable of attaining a minimum 28 day compressive strength of 3000 pounds per square inch. This is determined by breaking cylinders which are made by the technician as the concrete is placed in the forms. No barrier may be shipped until this strength is reached.

Since acceptance of the concrete is based on cylinders, yield tests are not taken. The slump requirement for precast concrete is two to five inches. The required air content is five to eight percent.

**Placing and
Finishing Concrete**

Concrete is placed in the forms in such a manner so that it has no more than five feet of free fall and no segregation occurs. It is placed in uniform layers and vibrated during and after placement.

Immediately after removing the forms, fins and irregular projections are removed from all exposed surfaces. All holes, honeycomb spots, cavities, broken corners or edges, and other defects must be thoroughly cleaned and saturated with water, then carefully pointed and trued with fresh mortar not more than 30 minutes old.

**Removal of
Forms and Curing**

Side forms may be removed when no distortion, slump, or misalignment of the concrete will result. The barrier must remain supported on the bottom until the concrete has reached a strength of at least 2000 psi as evidenced by test cylinders.

Immediately upon removing forms, the technician will inspect the barriers for defects and repaired as discussed in the last section.

Curing is required until the ultimate strength is achieved. Curing may be achieved by covering all exposed surfaces with two layers of wet burlap or steam curing. When wet burlap is used, it must be kept wet by automatic means. Steam curing is used in a controlled environment to speed up the curing process. Refer to section 707 of the Standard Specifications for details on steam curing and other accelerated curing methods. Liquid curing compound may be used only when a rubbed finish or sealer is not specified.

Handling and Shipping

Unless otherwise approved, precast barriers must be handled with a suitable hoisting device provided with a spreader sling. This sling prevents horizontal forces from being produced in the member due to lifting.

To avoid damage to the barriers during handling, storing and transportation, it is essential that they remain in an upright position at all times, and that they be lifted by the inserts or other approved devices.

During transportation, the barriers are supported with truck bolsters or battens no less than four inches wide and padded with $\frac{1}{2}$ inch of rubber. Wood blocks are placed under all tie chains to prevent chipping of the concrete.

Placement of Precast Units

Of major importance during placement of barrier units is to assure that the requirements for horizontal and vertical alignment are met. Horizontal and vertical alignment of adjacent units may not exceed $\frac{1}{4}$ inch across joints as measured from a ten foot straight edge. If you have a firm base upon which the precast units are set and meet the straight edge requirements, you will have a very good looking barrier wall.

Testing and Inspection Requirements; Basis for Use

Testing of concrete used in precast units is different than other concrete because of the flexibility the precast manufacture is allowed in the concrete mix design. Only air content, slump, and cylinder strength is tested.

The air content requirement for precast median barriers is five to eight percent. The slump requirement is from two to five inches. The most important of the tests, however, is the cylinders strength. The technician will make a minimum of five cylinders during a concrete pour. These cylinders are cured for up to 28 days and then broken to determine ultimate strength. Once the strength reaches 3000 psi, which could be in as little as two or three days or as much as 28 days, depending on the concrete mix design used, the barriers may be accepted and shipped to the job site.

As always, perform all testing of materials according to the frequency required in the frequency manual and check to see that all material are approved for use. Secure all required basis for use for the material records.

**Continuation of
Testing and
Inspection
Requirements:
Basis for Use**

Measure and document all items for payment on a daily basis. These measurements shall be accurate enough for final payment so that additional measurements at a later date will not be required.

CAST - IN - PLACE CONCRETE MEDIAN BARRIER

Description

Cast-in-place concrete median barrier is dimensionally similar to precast concrete median barrier, but the forms are set at the exact location of the finished product. Many times cast-in-place barrier is not moved after being poured and the testing requirements and basis for use is, therefore, somewhat different than the precast barrier.

Forms

Requirements for forms for concrete median barrier are much the same as for curb. These forms are generally made of wood or steel and are in eight or ten foot sections. Forms should be cleaned and oiled before use. Wooden forms should be inspected often between pours as they tend to wear out quickly and may need to be repaired or replaced often.

Vertical and horizontal alignment is vital to the appearance of the barrier. The specifications require that the surfaces of the concrete vary by no more than $\frac{1}{4}$ inch in ten feet. This can easily be achieved if the forms are set true and straight.

When pouring barriers in conventional wood or metal forms, the force of the concrete and the vibration will tend to push the forms up from the ground. For this reason forms must be tied to the grade either by a combination of stakes, braces, or weights before the pour.

**Concrete
Composition,
Placement , &
Finishing**

Unless otherwise specified, concrete used in cast-in-place concrete median barriers will be class A concrete in accordance with section 702 of the Standard Specifications.

Concrete should be placed in the forms in at least two layers, each layer being vibrated as the concrete is being poured.

**Continuation of
Concrete
Composition,
Placement, &
Finishing**

The top of the barrier is finished with a hand trowel and the edges are chamfered, or beveled. Immediately following the removal of the forms, all fins and irregular projections must be removed from all exposed surfaces. All cavities and holes from form ties and honeycomb spots, broken corners or edges, and other defects must be thoroughly cleaned, saturated with water, and carefully pointed and trued with mortar.

If the barrier is being slip-formed, the concrete is placed into the slip-form machine conveyor or auger and fed into the form. The slip-form machine has vibrators built into it to consolidate the concrete as it enters the forms. If properly done, as the machine passes the minimum of hand finishing should be necessary at this point. The final finish on a slip-form barrier may be an approved brush finish.

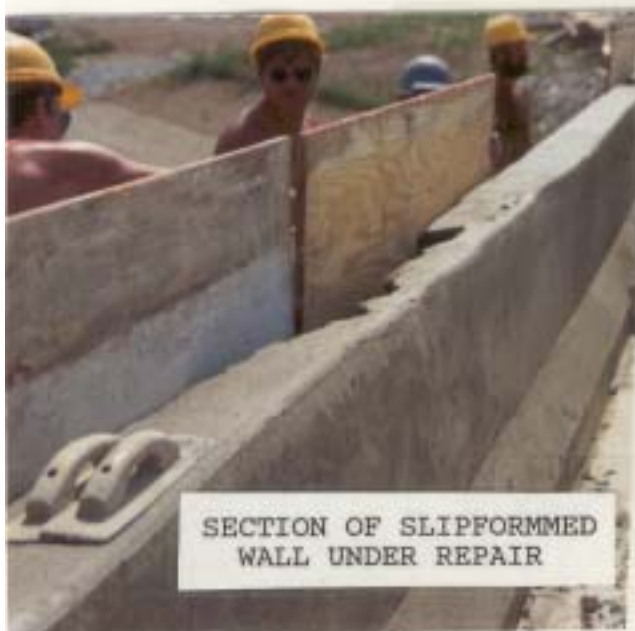




GOOD WALL WITH FINAL FINISHING



UNACCEPTABLE CRACKS TO BE REPAIRED



SECTION OF SLIPFORMMED
WALL UNDER REPAIR



SECTION OF SLIPFORMMED
WALL TO BE REPAIRED

Joints

Standard Sheet 602-CCMB-01 & 02 shows the various types of joints that may be required for the construction of cast-in-place concrete median barrier.

An expansion joint type A is required five feet before and after an inlet and ten feet away from any bridges pier or bent. In any event there may be no more than 400 feet between type A joints.

A type B joint is sawed into the barrier to a depth of one and one half inches and at intervals no greater than 20 feet.

If the barrier is placed next to a concrete pavement or base, a double application of curing compound shall be placed next to the pavement or base before the barrier is poured.



Sealing

Regardless of the method of construction, all exposed surfaces of the concrete median barrier shall be sealed with a clear sealer. The sealers that may be used will be those identified on the Approved List of Proprietary Portland Cement Concrete Sealers as (INDOT Clear Sealer).

**Continuation of
Sealing**

The time of application, the rate of application, and temperature requirements shall be as listed on the Approved List of Proprietary Portland Cement Concrete Sealers for the particular sealer used.

Before application of the sealer, the surface of the median barrier shall be thoroughly cleaned by sandblasting. Final cleaning will be done with compressed air free of water, grease, or other foreign substances.

A sample of the Approved List of Proprietary Portland Cement Concrete Sealer is available from District Testing Department via memos, handouts, and CD's.

Reflectorization

All concrete median barrier must be reflectorized with wide angle reflectors as shown on the plans. These reflectors are glued to the barrier with a mastic.

There are two colors of reflectors used, white and yellow. The white is always used to the right of the traffic and the yellow is always used to the left of the traffic.

**Construction &
Inspection Procedures**

Placement of cast-in-place concrete median barrier by the slip-form method must be observed closely so that none is placed that does not meet the straight-edge requirements of 1/4 inch in ten feet. If the tolerance is not being met, the contractor should be stopped before an excessive amount of poor barrier is placed that would have to be removed.

Perform all on site testing of materials according to the frequency required in the frequency manual and check to see that all materials are tested and approved for use. Secure all required basis for use for the material records.

Measure and document all items for payment on a daily basis. These payments should be accurate enough for final payment so that additional measurements at a later date will not be required.

TEMPORARY CONCRETE BARRIERS

Description	Temporary concrete barrier is precast in a manner similar to precast concrete median barrier. They are fabricated with the same strength and straight-edge requirements.
Placement & Anchor	Temporary concrete barrier is to be located as shown on the plans or as directed. Anchoring of the barriers is required where little or no movement of the barrier by traffic can be tolerated. These areas will be determined from the plans and by the Project Engineer. When anchoring is required, it will be done according to the details shown on Standard Sheet 801-TCCB-04
Delineation	<p>Temporary concrete barriers are delineated with type C construction warning lights and wide angle reflectors as shown on the plans. If the barriers are used to separate two-way traffic, the warning lights will have bi-directional lenses so that they serve as warning to both directions of traffic.</p> <p>Wide angle reflectors used on temporary barriers, as are others, are white on the right side of traffic and yellow on the left side.</p>
Measurement & Payment	Temporary concrete median barrier is measured and paid for by the linear foot. It is paid for only once no matter how many times it is moved to accommodate different phases of construction. Warning lights, wide angle reflectors, and anchoring is all included in the cost of barriers.
Construction & Inspection Procedures	<p>Temporary concrete barrier is to be inspected for correct location as shown on the plans as well as correct anchoring hardware and anchoring locations and methods. Also, check that the correct reflectorization is being used and at the proper spacing. This will include warning lights and reflectors. Check to see that all materials are approved for use and secure all required basis for use for the material records.</p> <p>Always measure and document all items for payment on a daily basis. These measurements shall be accurate enough for final payment so that additional measurements will not be required at a later date.</p>